CHEST PAIN

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AGENDA

- 1) Scope
- 2) Chest pain characteristics
- 3) Acute chest pain initial evaluation
- 4) Treatment of ACS
- 5) Treatment of stable chest pain
- 6) Non CAD cardiac pain

CHEST PAIN PREVALENCE

- 2nd most common emergency department visit chief complaint
  - >6.5 million visits per year
  - 4.7% of ED visit
- 4 million outpatient visits per year
- CAD affects >18.2 million adults
- CAD is leading cause of death at >365,000 annually
- But… In patients presenting to the ED with chest pain, only 5.1% have ACS

CHEST PAIN DIFFERENTIAL DIAGNOSIS

CAN'T MISS

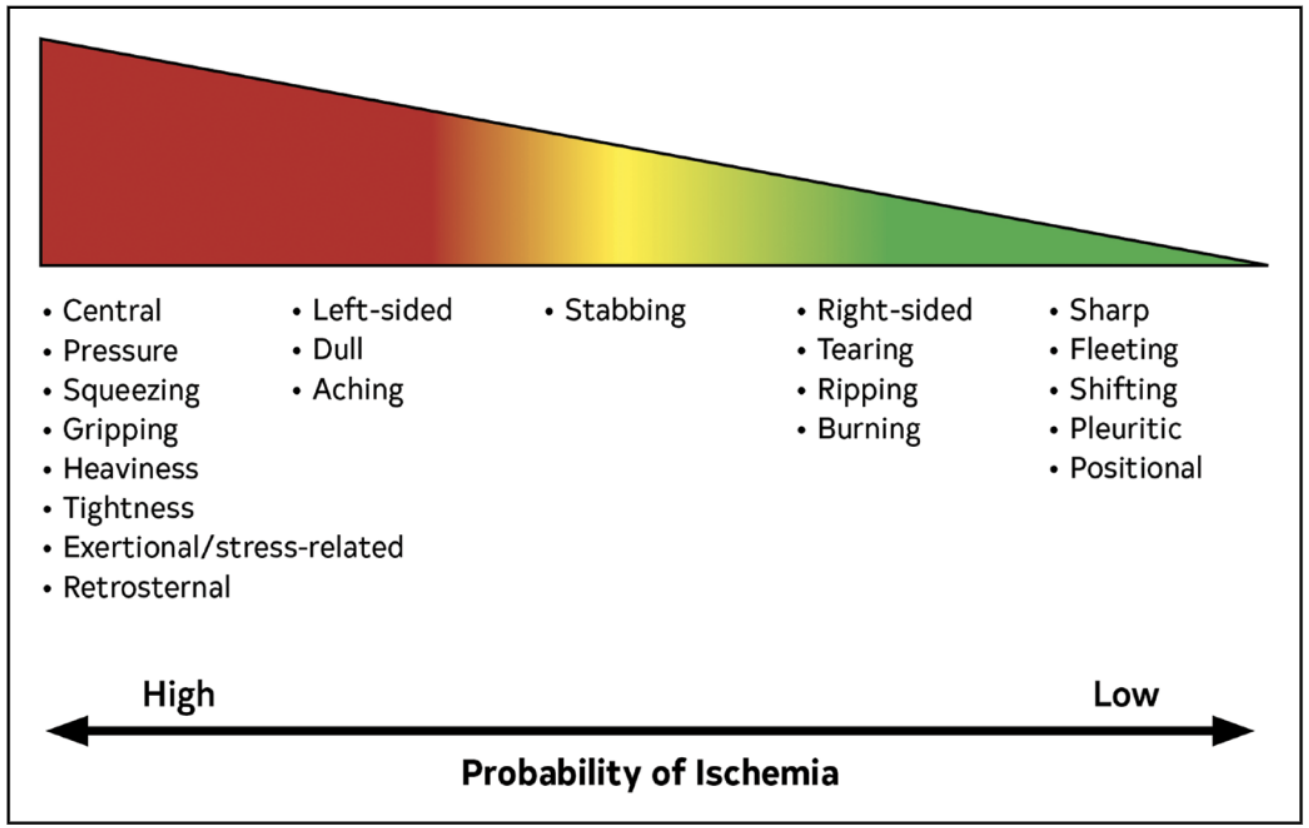
- Coronary artery disease
- Pulmonary embolism
- Aortic dissection
- Esophageal Rupture
- Pericarditis/Myocarditis

COMMON ETIOLOGIES

- GI
  - GERD, PUD, pancreatitis
- Pulmonary
  - Pneumonia, pleural irritation
- MSK/chest wall
  - Costochondritis, chest wall trauma, Herpes zoster

ANGINAL CHEST PAIN CHARACTERISTICS

- Substernal pain, pressure, heaviness
- Onset with exertion or emotional stress
- Resolves with rest or nitroglycerin
- Not always!
  - Crescendo decrescendo symptoms
  - Consider dyspnea in Women and Diabetics
  - Pain radiation
  - Associated symptoms: diaphoresis, nausea



Pretest Probabilities of Obstructive CAD in Symptomatic Patients
(A) according to age, sex, and symptoms;
(B) according to age, sex, symptoms, and CAC

Age, y	Chest Pain		Dyspnea	
	Men	Women	Men	Women
30–39	≤4	≤5	0	3
40–49	≤22	≤10	12	3
50–59	≤32	≤13	20	9
60–69	≤44	≤16	27	14
70+	≤52	≤27	32	12

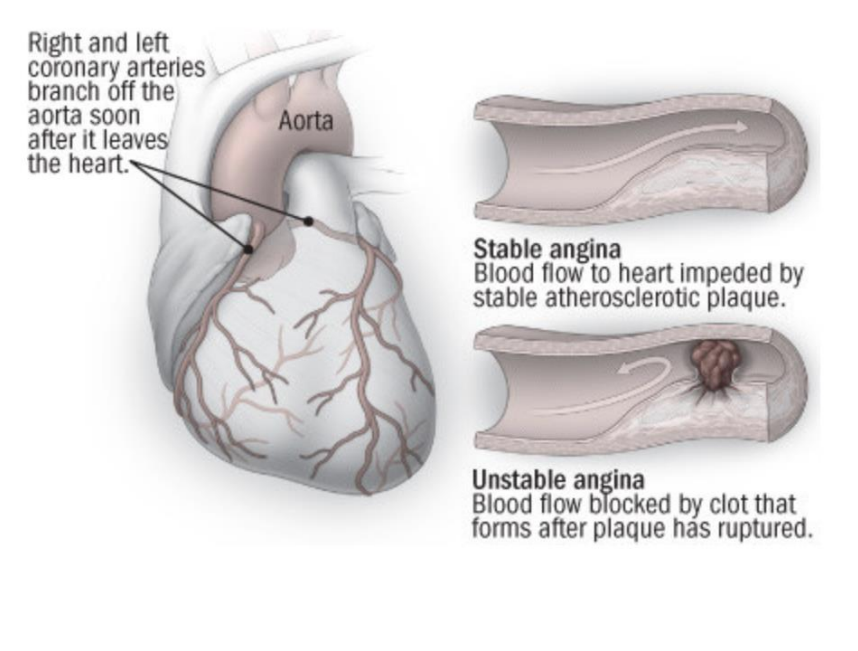
CHEST PAIN EVALUATION

- The History is key!
- EKG
- Troponin
- Stress Testing
- Anatomical evaluation with CCTA vs Invasive Coronary Angiography

CHEST PAIN EVALUATION

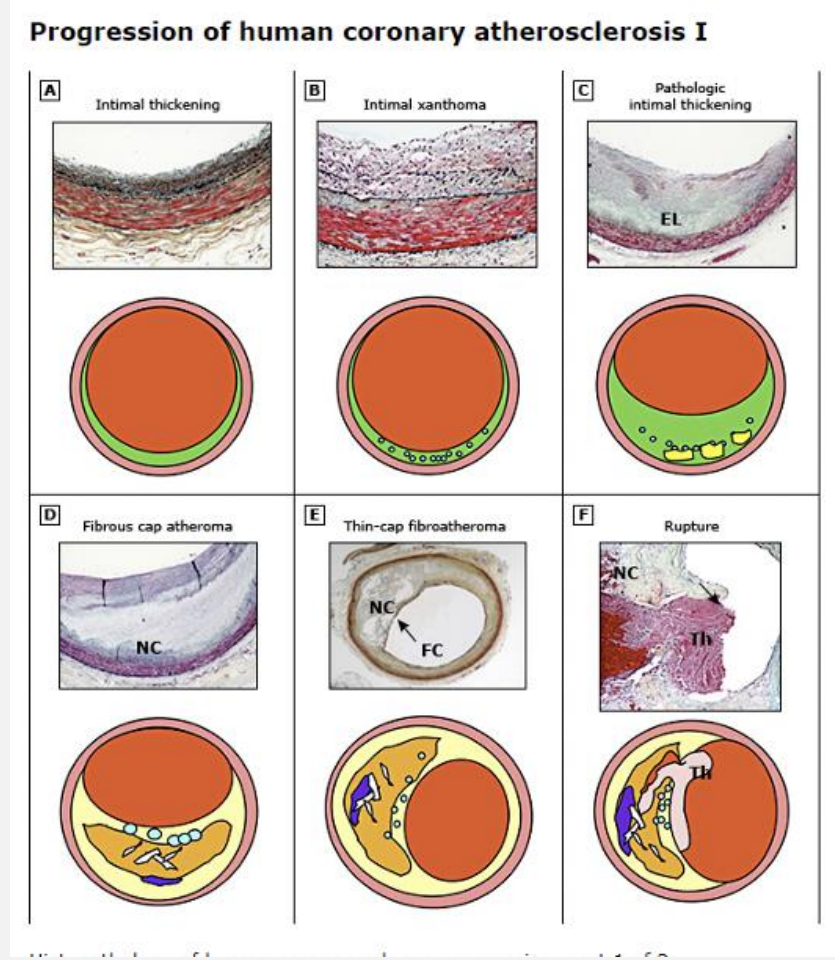
STABLE ANGINA

- Chronic stable or slowly progressive chest pain



ACUTE CORONARY SYNDROME

- Unstable Angina
- NSTEMI
- STEMI

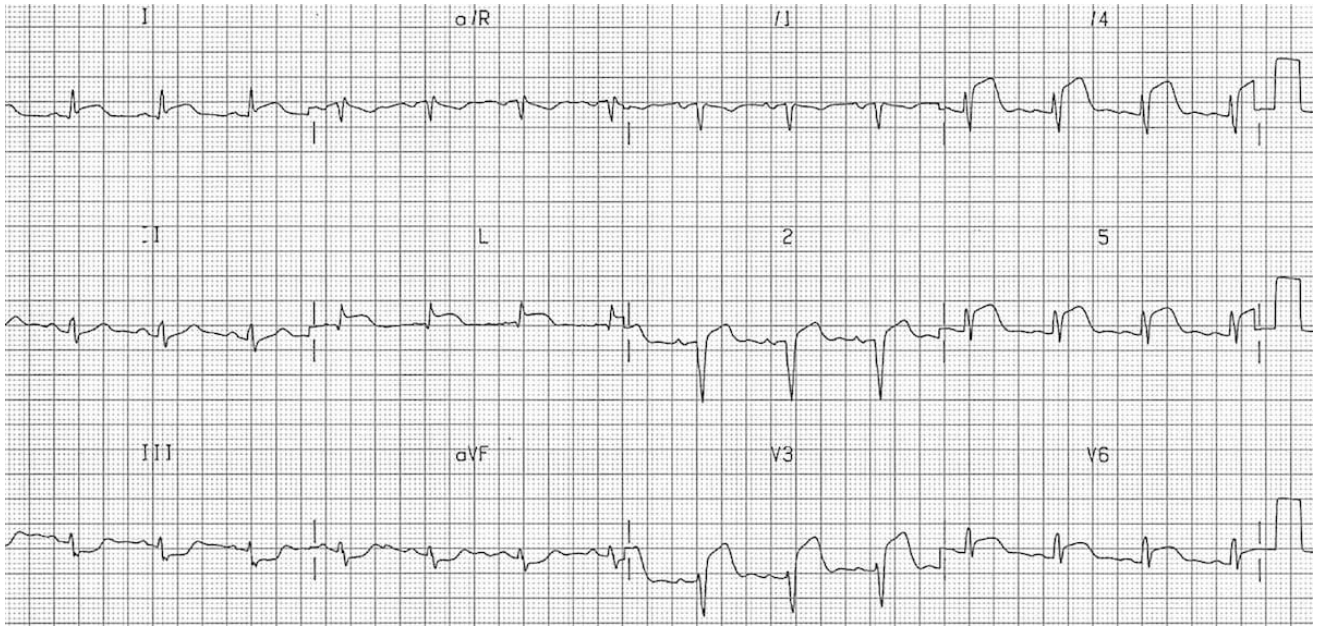


ACUTE CHEST PAIN EVALUATION

- New onset or increasing angina that is frequent, longer in duration, or occurs with less exertion than previous angina
- Should be prepared to evaluate this in any setting
  - Clinic
  - Urgent Care
  - Emergency Department
  - Hospital

2021 ACC/AHA CHEST PAIN GUIDELINES CLASS I RECOMMENDATIONS

- Unless clearly noncardiac obtain EKG
- EKG should be obtained and evaluated for STEMI within 10 minutes of presentation regardless of the setting
  - If unable to do so, should be directed to a location that is able
- Patients with clinical ACS should be transferred to the ED by EMS
- If acute symptoms, a troponin should be obtained

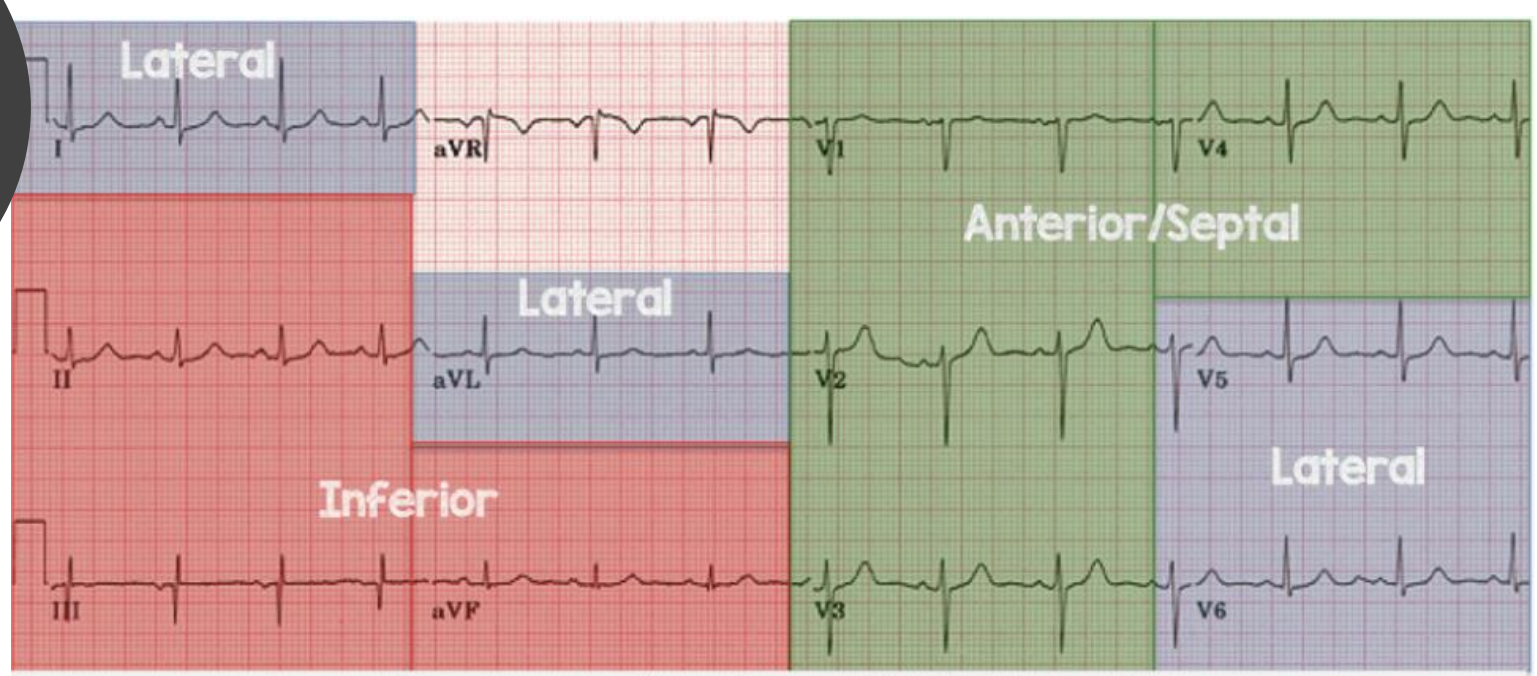


STEMI

1. Men <40 V_2 and V_3 should be 0.25 mV (2.5 mm)
2. Men >40 should be 0.2 mV (2 mm) in leads V_2 and V_3
3. For women 0.15 mV (1.5 mm) in leads V_2 and V_3
4. 0.1 mV (1mm) in all other leads
5. Remember “1 and for V2-V3: 1.5, 2, 2.5”
6. Look for reciprocal changes!

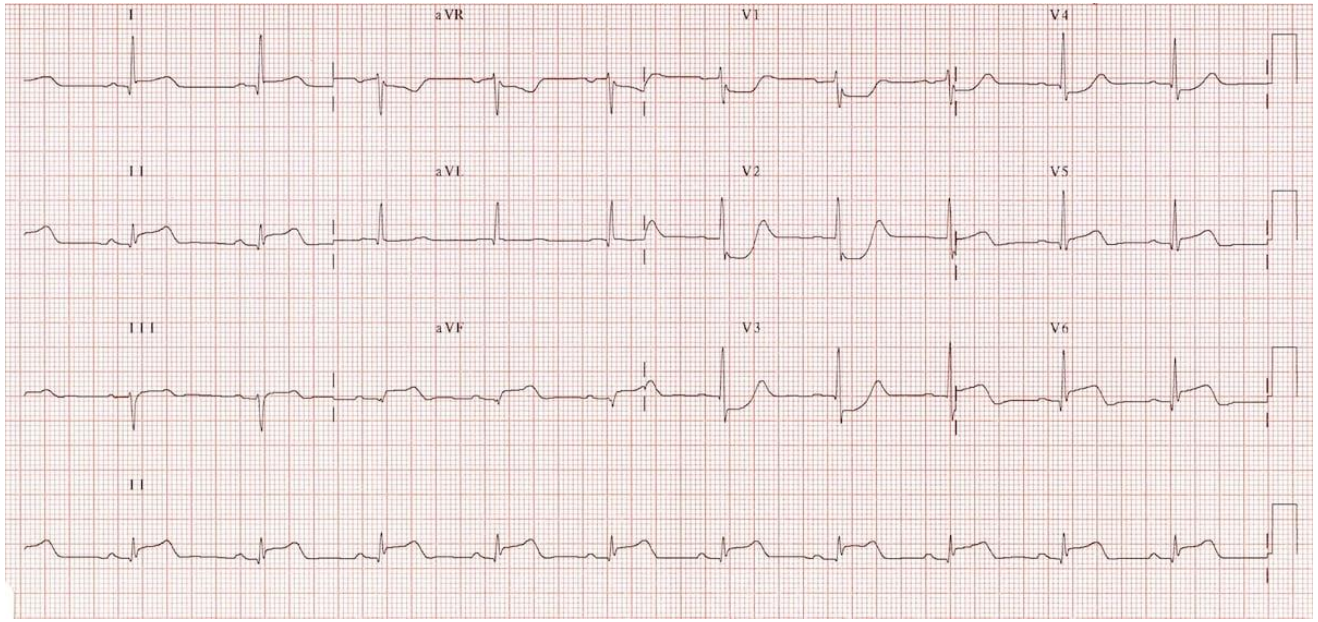
AHA/ACCF/HRS Recommendations for the Standardization and Interpretation of the Electrocardiogram

STEMI Localization



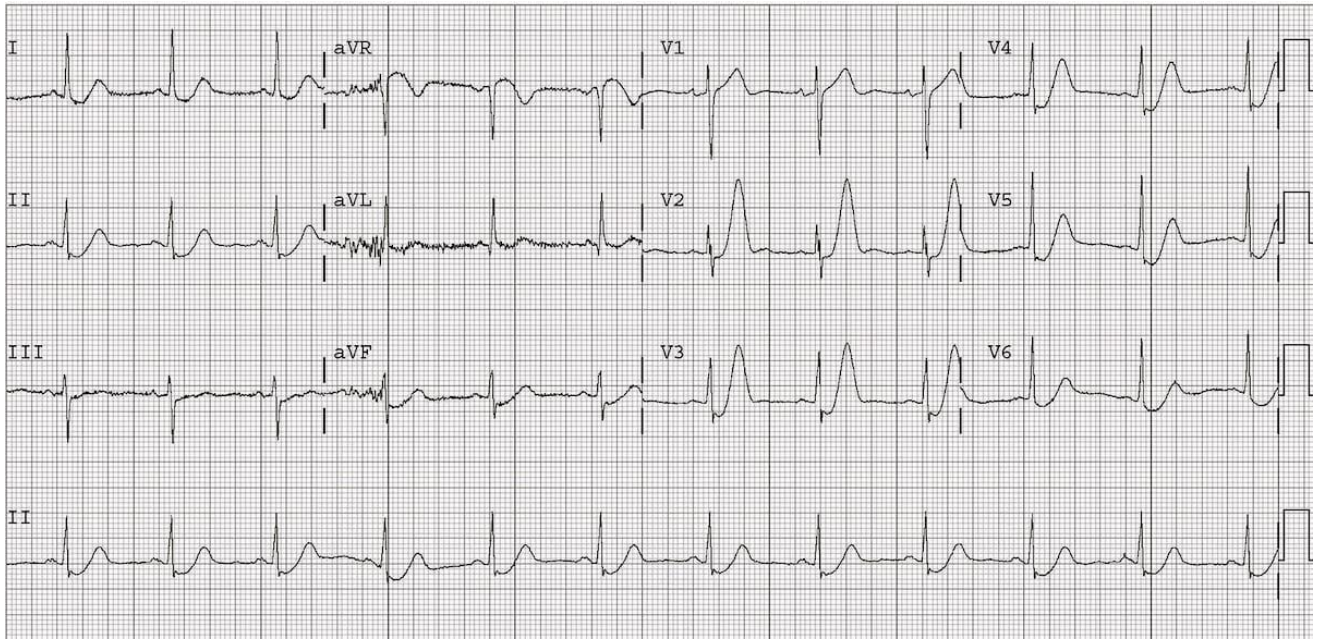
Coronary Anatomy & ECG Leads

Lateral Leads	I, aVL, V5 - V6	LCx or Diagonal of LAD
Inferior Leads	II, III, aVF	RCA and/or LCx
Anterior/Septal Leads	V1 - V4	LAD



POSTERIOR MI

- ST depression in V2-3
- Tall, broad R waves (> 30ms) in V2-3
- Dominant R wave (R/S ratio > 1) in V2
- Upright terminal portions of the T waves in V2-3

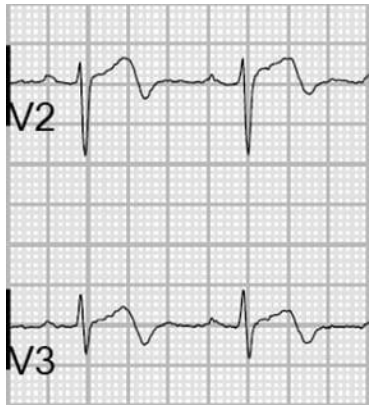


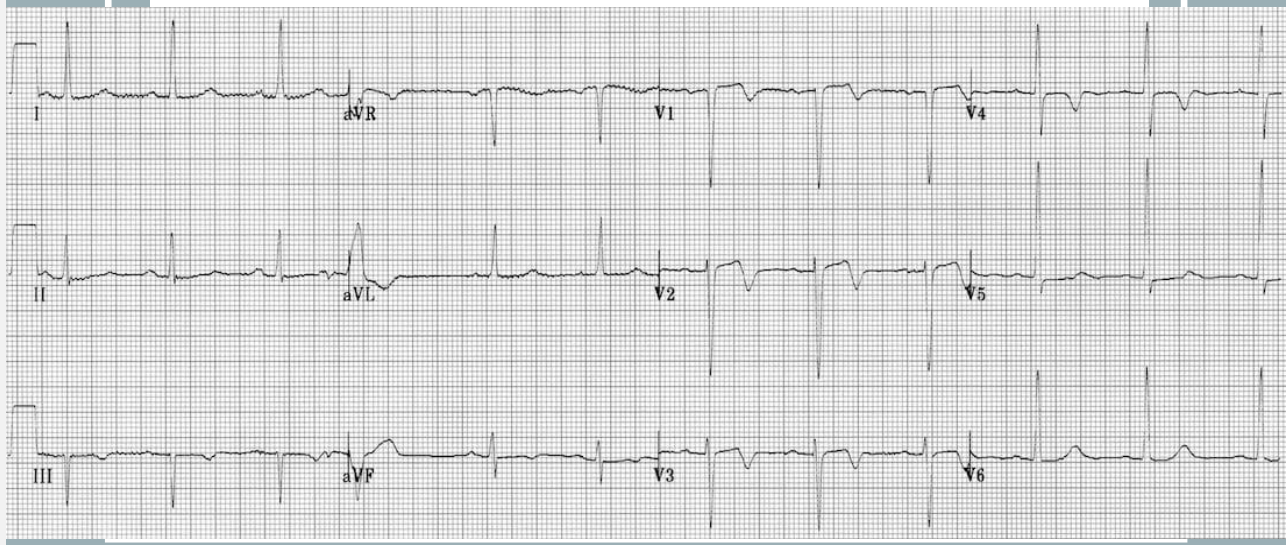
DE WINTER'S SIGN

- Tall, prominent, symmetrical T waves in the precordial leads
- Upsloping ST segment depression > 1mm at the J point in the precordial leads
- Absence of ST elevation in the precordial leads

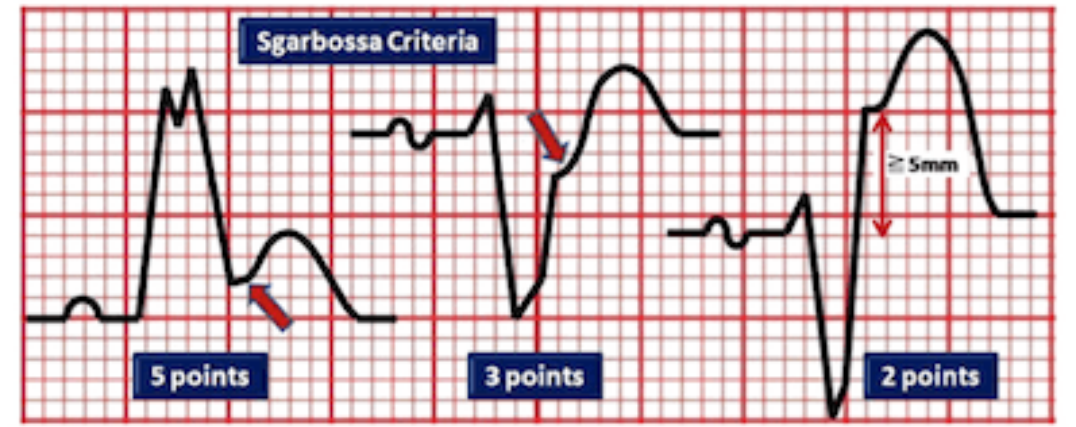
WELLEN'S SIGN

- Type A: Biphasic T wave in V2-V3
- Type B: Deeply inverted T wave in V2-V3
- Not a STEMI equivalent but suggestive of very tight LAD disease





PACEMAKERS AND KNOWN LBBB



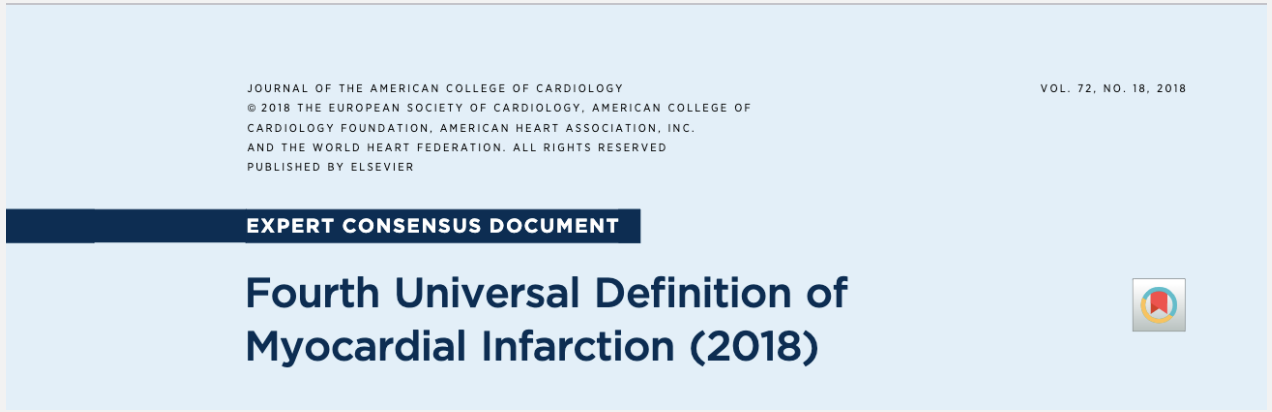
Sgarbossa ECG Criteria for LBBB	
Concordant STE ≥1mm	5 points
STD ≥1mm in V1 – V3	3 points
Discordant STE ≥5mm	2 points

Cai Q, Mehta N, Sgarbossa EB, et al. The left bundle-branch block puzzle in the 2013 ST-elevation myocardial infarction guideline: from falsely declaring emergency to denying reperfusion in a high-risk population. Are the Sgarbossa Criteria ready for prime time? *Am Heart J*. 2013;166(3):409-413.

BIOMARKERS

- Should use Troponin T or Troponin I
  - >99% ULN signifies **myocardial injury**
  - A rise of fall indicates the injury is acute (vs chronic)
  - **Myocardial ischemia** is present when there is also chest pain, EKG changes or new wall motion abnormalities on echocardiogram
- High Sensitivity Troponin (hs-cTn) is preferred
  - More sensitive = higher NPV
- CK-MB and myoglobin are not useful

- If chest pain present for 3 hours and hs-cTn normal, ACS ruled out
- hs-cTn trend at 1, 2, or 3 hours
- Traditional Troponin assay trend at 3-6 hours



INITIAL CHEST PAIN EVALUATION SUMMARY

- History, history, history!
- Based on history, classify as cardiac, possible cardiac, or noncardiac
  - Avoid atypical chest pain
- Acute vs chronic symptoms
- For acute symptoms evaluate with EKG and Troponin
- Decide:
  - Stable Angina
  - ACS (STEMI, NSTEMI, UA)

HEART

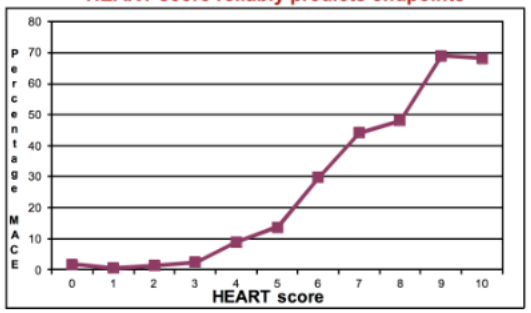
HEART score for chest pain patients

History (Anamnesis)	Highly suspicious	2	
	Moderately suspicious	1	
	Slightly suspicious	0	
ECG	Significant ST-deviation	2	
	Non-specific repolarisation disturbance / LBBB / PM	1	
	Normal	0	
Age	≥ 65 years	2	
	45 – 65 years	1	
	≤ 45 years	0	
Risk factors	≥ 3 risk factors *or* history of atherosclerotic disease	2	
	1 or 2 risk factors	1	
	No risk factors known	0	
Troponin	≥ 3x normal limit	2	
	1-3x normal limit	1	
	≤ normal limit	0	
		Total	

Risk factors for atherosclerotic disease:

Hypercholesterolemia	Cigarette smoking
Hypertension	Positive family history
Diabetes Mellitus	Obesity (BMI>30)

HEART score reliably predicts endpoints



HEART	~ % pts	MACE/n	MACE	Death	Proposed Policy
0-3	32%	38/1993	1.9%	0.05%	Discharge
4-6	51%	413/3136	13%	1.3%	Observation, risk management
7-10	17%	518/1045	50%	2.8%	Observation, treatment, CAG

*MACE = Major Adverse Cardiac Event = Myocardial Infarction, PCI/CABG, all-cause death. Based on N=6174

Literature:

1. Chest pain in the emergency room: value of the HEART score.
Six AJ, Backus BE, Kelder JC. Neth Heart J. 2008;16:191-6.
2. Chest pain in the emergency room: a multicenter validation of the HEART Score.
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3. A prospective validation of the HEART score for chest pain patients at the emergency department.
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4. The HEART score for the assessment of patients with chest pain in the emergency department
Six AJ, Cullen L, Backus BE, et al. Crit Pathways in Cardiol 2013;12:121–126.
5. Impact of using the HEART score in chest pain patients at the emergency department: a stepped wedge, cluster randomized trial. Poldervaart JM, et al. Annals of Internal Medicine. 2017. Epub ahead of print

Questions and comments:

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www.heartscore.n

USE CLINICAL DECISION MAKING PATHWAYS

- Many Choices
  - HEART
  - TIMI
  - GRACE

STRESS TESTING PEARLS

- Use to diagnose CAD in intermediate to high probability patient
- Or used in patients with known CAD to confirm angina and localize ischemic territory

STRESS TESTING PEARLS

MODALITIES

- Plain EKG treadmill
- Stress Echocardiogram
- Nuclear Stress Testing (SPECT or PET)
- Cardiac MRI
  - Pharmacologic only

EXERCISE VS PHARMACOLOGIC

- All patient's that are able to ambulate should exercise
  - EKG changes
  - Blood pressure response
  - Functional Capacity
  - Duke Treadmill Score
- LBBB or RV paced should consider pharmacologic nuclear study
  - Abnormal septal activation can lead to false positives

EXERCISE TREADMILL TEST (ETT)

KEY POINTS

- All exercise studies require obtaining a target HR of 85% Age predicted maximum
  - 220-Age = Max HR

CONTRAINDICATIONS

- Resting ST segment abnormalities
- LVH
- LBBB
- Paced rhythm
- WPW pattern on EKG
- Resting BP >220/110

STRESS ECHOCARDIOGRAPHY

KEY POINTS

- No radiation
- Can assess for LV function and valvular disease at the same time

CONTRAINDICATIONS

- Not many contraindications to echocardiography
- Dobutamine (pharmacologic agent)
  - Ventricular arrythmias
  - Ideally avoid with Afib
  - BP >220/110

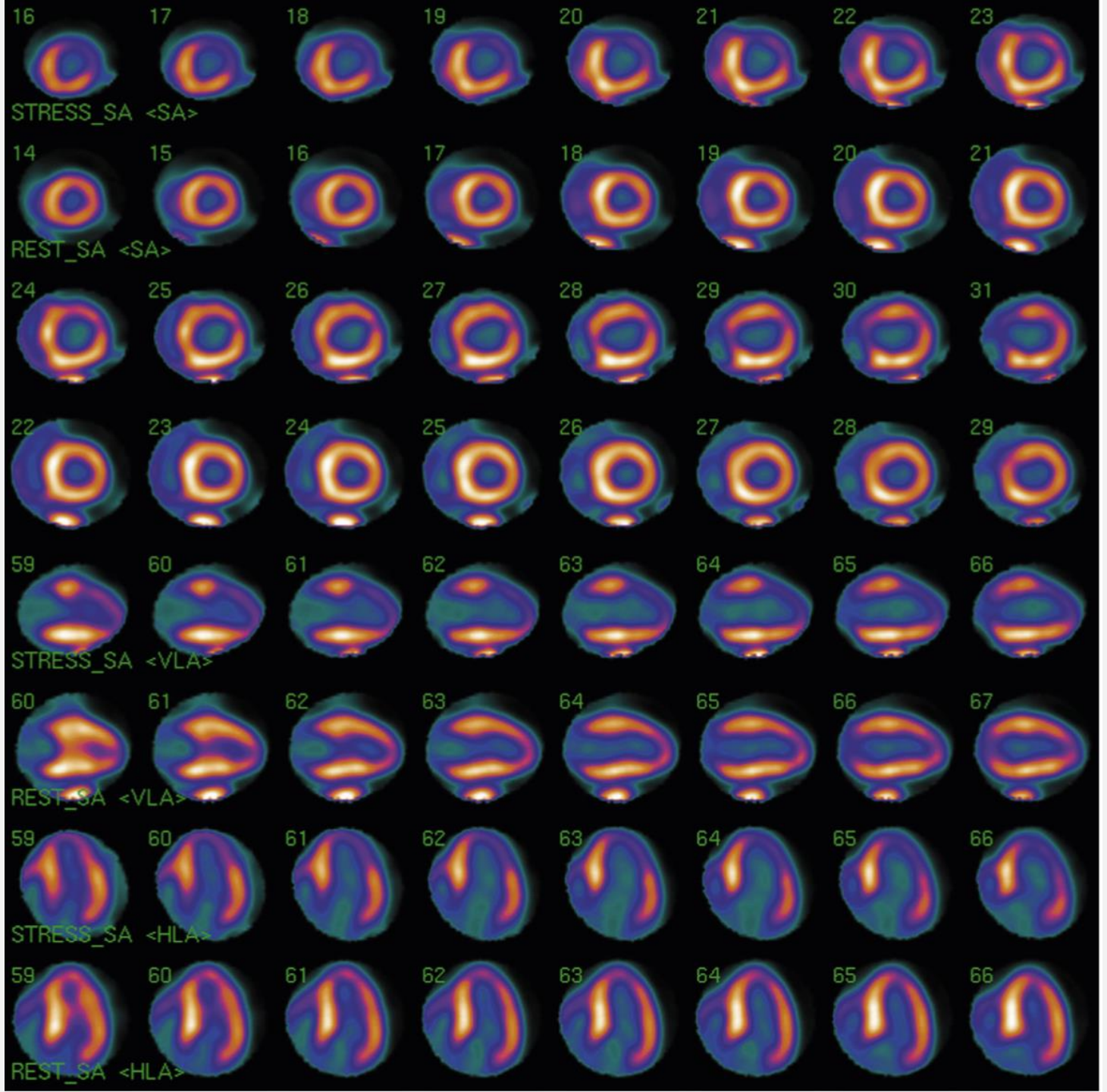
NUCLEAR STRESS TEST

KEY POINTS

- PET provides better imaging then SPECT but is not widely available and is only pharmacologic
- Modality of choice for paced rhythms and LBBB

CONTRAINDICATIONS

- Uses Radiation
- Pharmacologic agent is typically adenosine or Regadenoson
  - Vasodilators
- Heart block
- Severe Aortic Stenosis
- Asthma/COPD with active wheezing
- Hypotensive (SBP <90 mmHg)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14 15 16 17 18 19 20 21
REST_SA <SA>
24 25 26 27 28 29 30 31
22 23 24 25 26 27 28 29
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60 61 62 63 64 65 66 67
REST_SA <VLA>
59 60 61 62 63 64 65 66
STRESS_SA <HLA>
59 60 61 62 63 64 65 66
REST_SA <HLA>

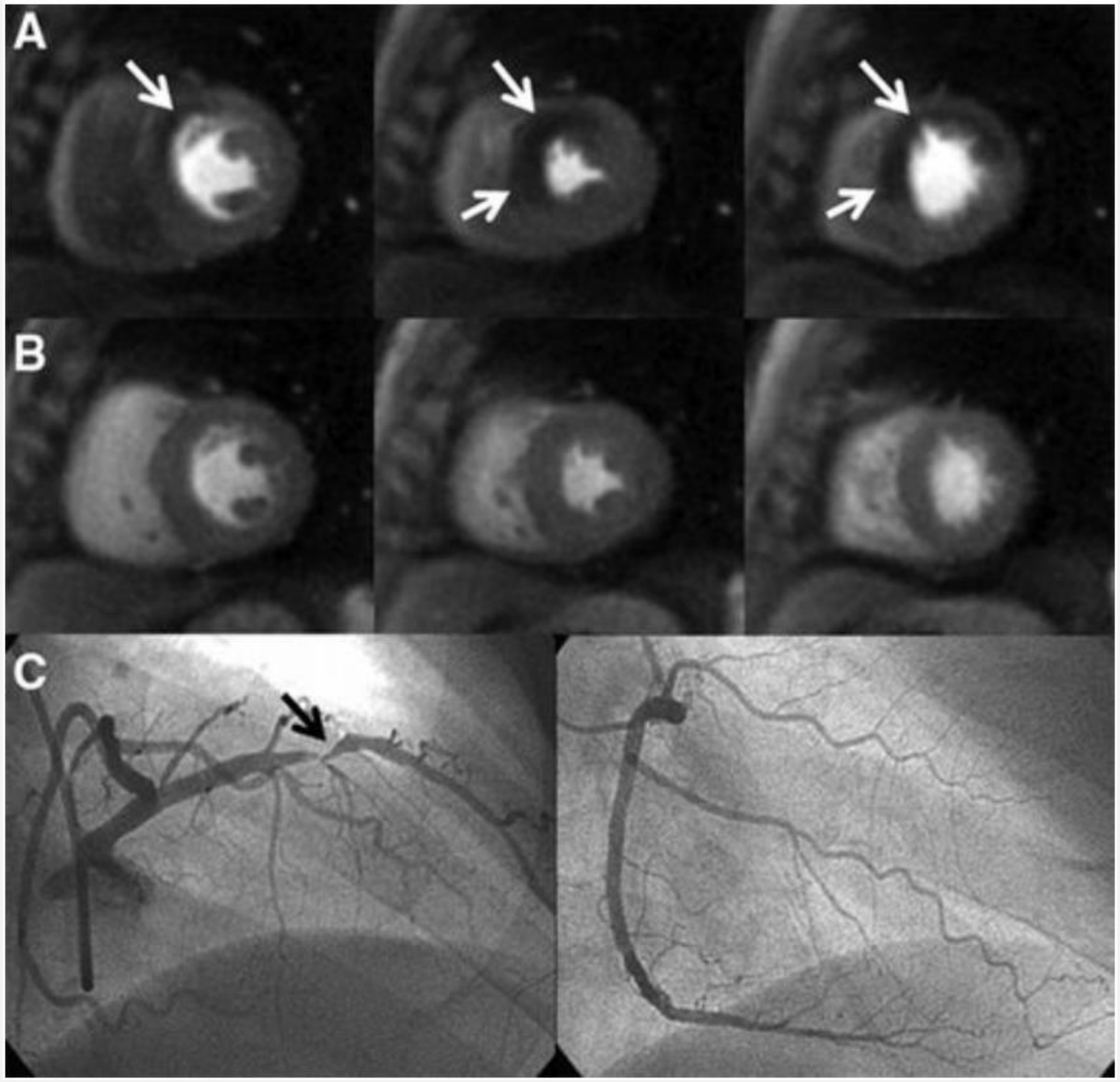
STRESS CARDIAC MRI

ADVANTAGES

- No radiation
- Accurate LV function and chamber size assessment
- Can assess for myocarditis

CONTRAINDICATION

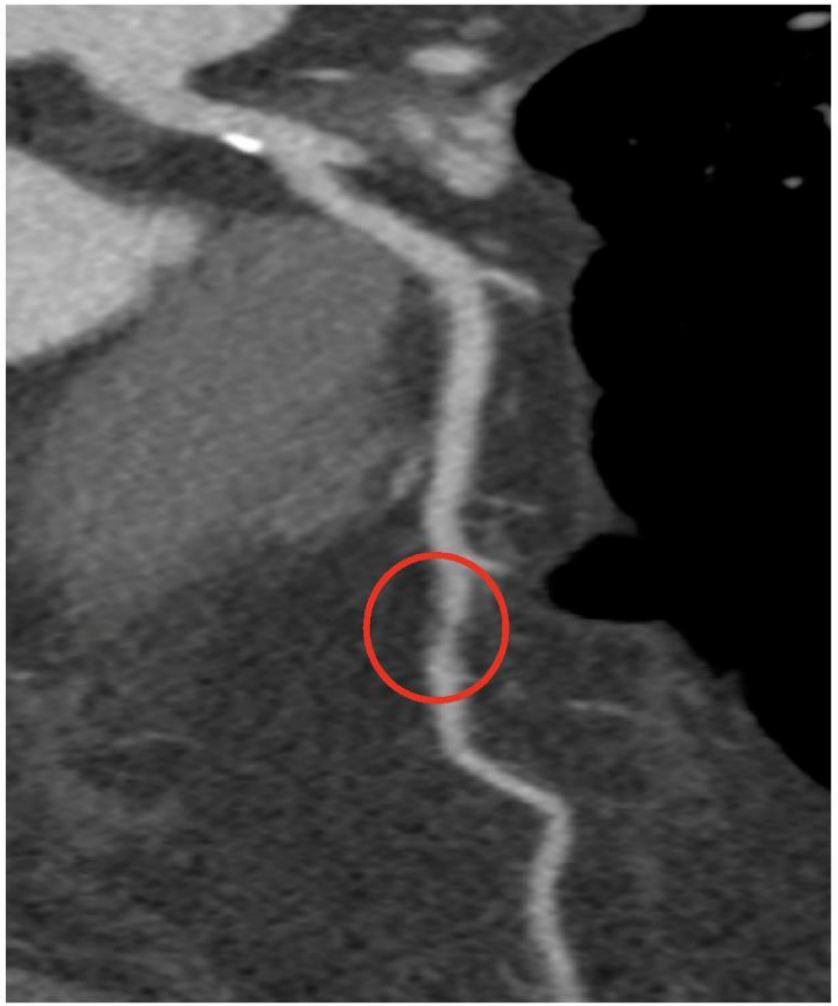
- Expensive and not widely available
- GFR <30
- Allergy to gadolinium
- Uses adenosine

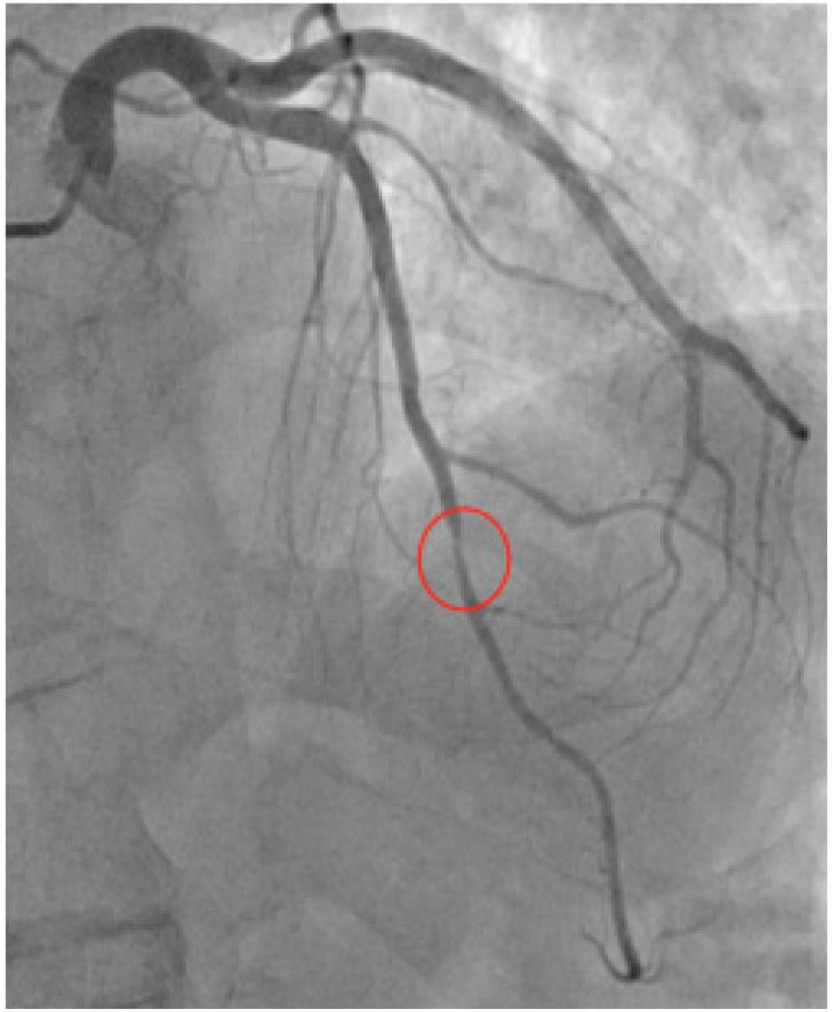

A
B
C

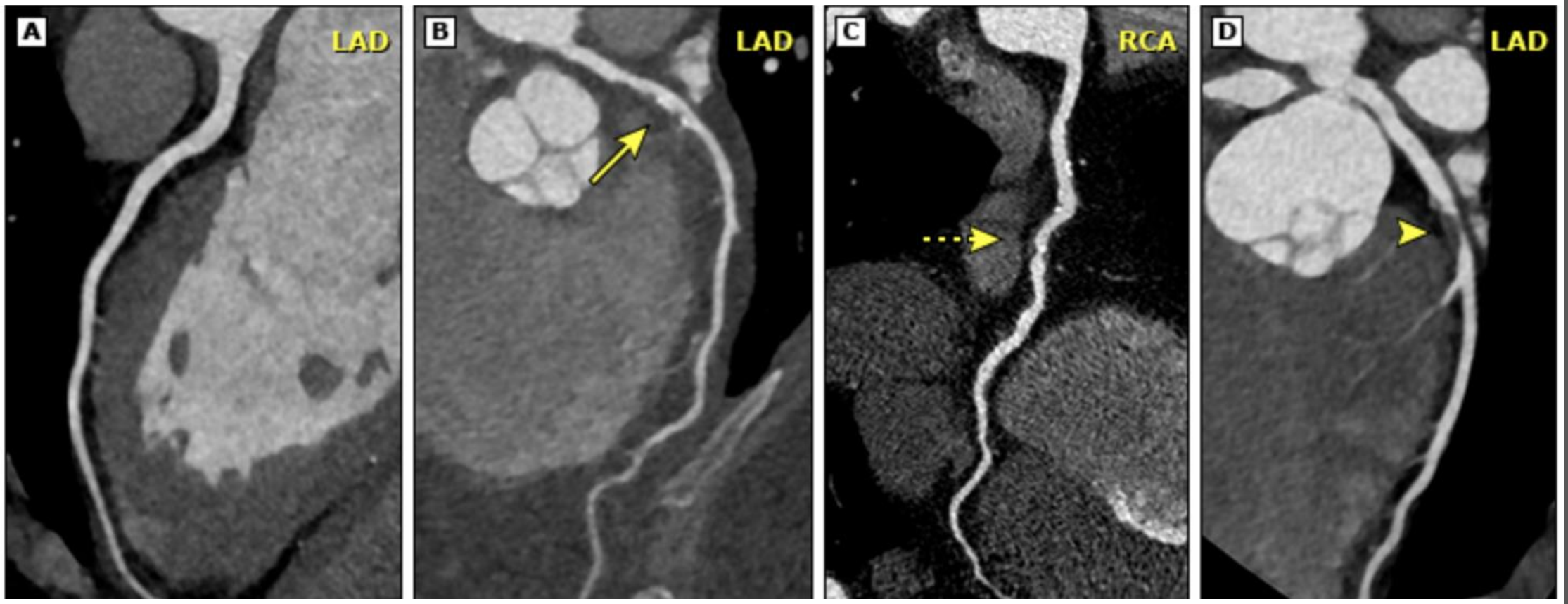
WHAT ABOUT CCTA?

- Noninvasive way to define coronary anatomy
- In acute chest pain and can reduce the time to diagnosis
- Long term outcomes are similar to other stress test modalities

- <u>Indications:</u>
- Lower risk patients to rule out ACS
- Nondiagnostic stress test results
- To define anatomy after a positive stress test in place of ICA
  - More on the ISCHEMIA trial later!
- Avoid with known large coronary calcifications or prior PCI





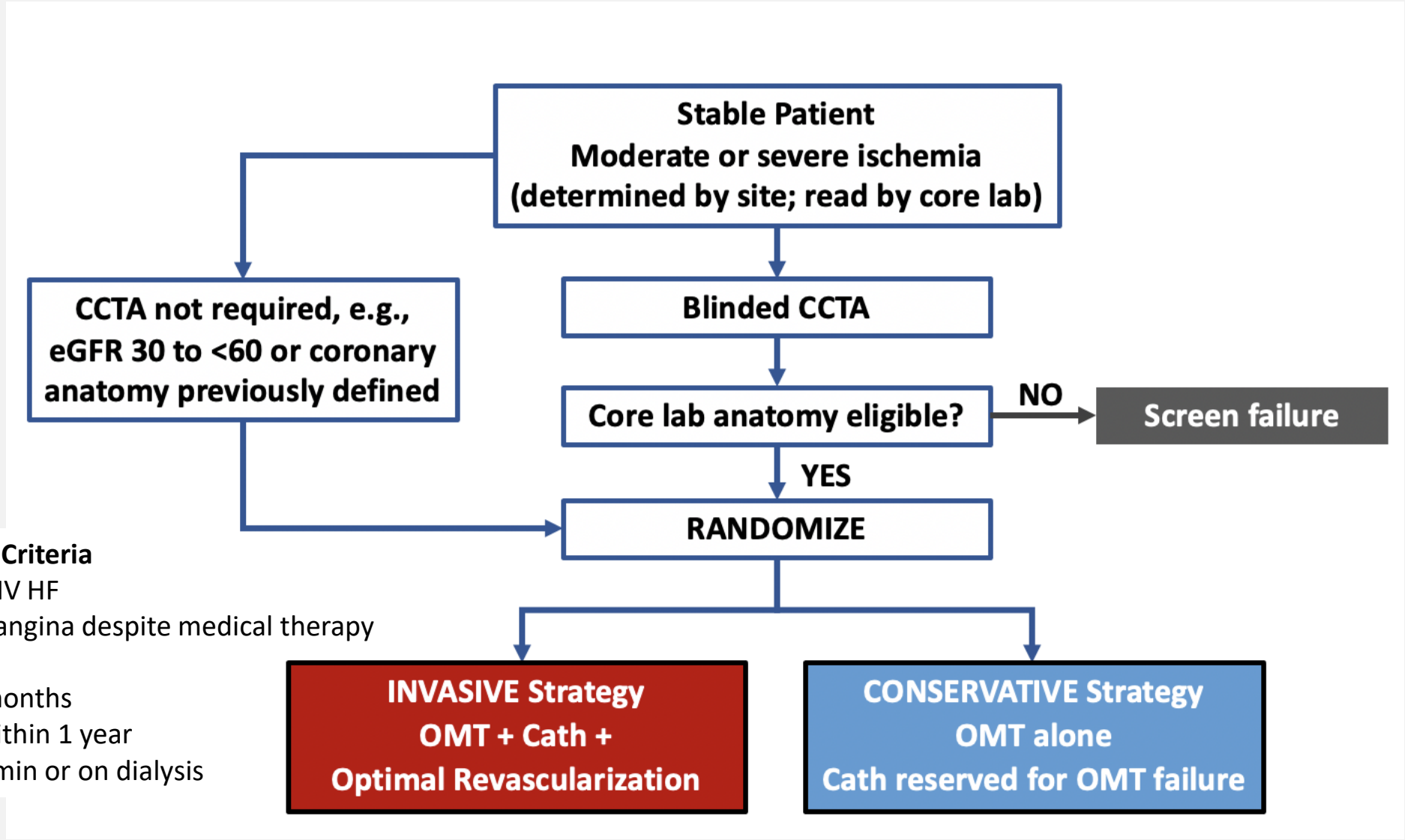

A
LAD
B
LAD
C
RCA
D
LAD

BRIEF COMMENTS ABOUT STABLE ANGINA MANAGEMENT

- Aspirin
- High intensity statin
- Risk factor modification
  - HTN goal <130/80
  - Cholesterol
  - Smoking
  - DM
- Beta Blockers
- Calcium channel blockers
  - Diltiazem, Verapamil, Amlodipine
- Long acting nitrates
- Ranolazine 500-1000 mg BID
  - Avoid if cirrhosis
  - Monitor for QTc prolongation
- Who to revascularize?

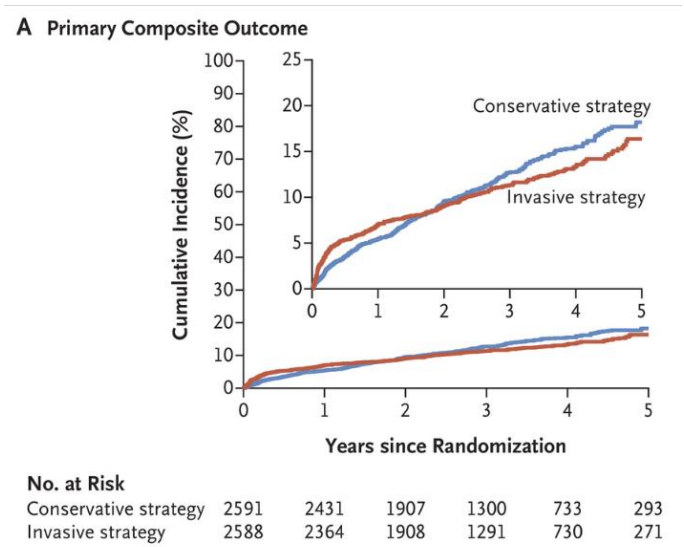
ISCHEMIA TRIAL

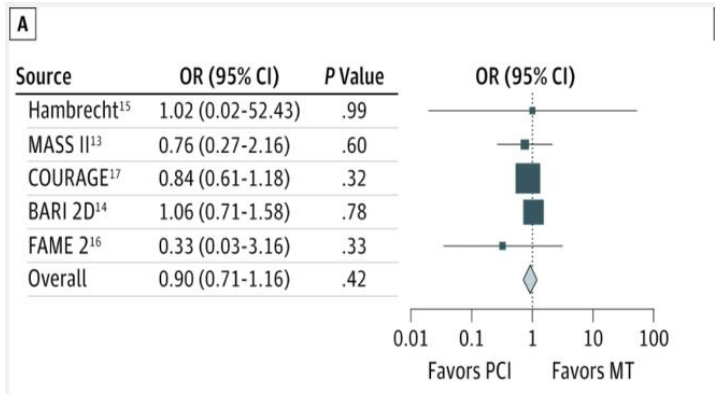
In stable patients with at least moderate ischemia on a stress test, is there a benefit to adding cardiac catheterization and, if feasible, revascularization to optimal medical therapy?



Major Exclusion Criteria

- NYHA Class III-IV HF
- Unacceptable angina despite medical therapy
- EF < 35%
- ACS within 2 months
- PCI or CABG within 1 year
- eGFR <30 mL/min or on dialysis



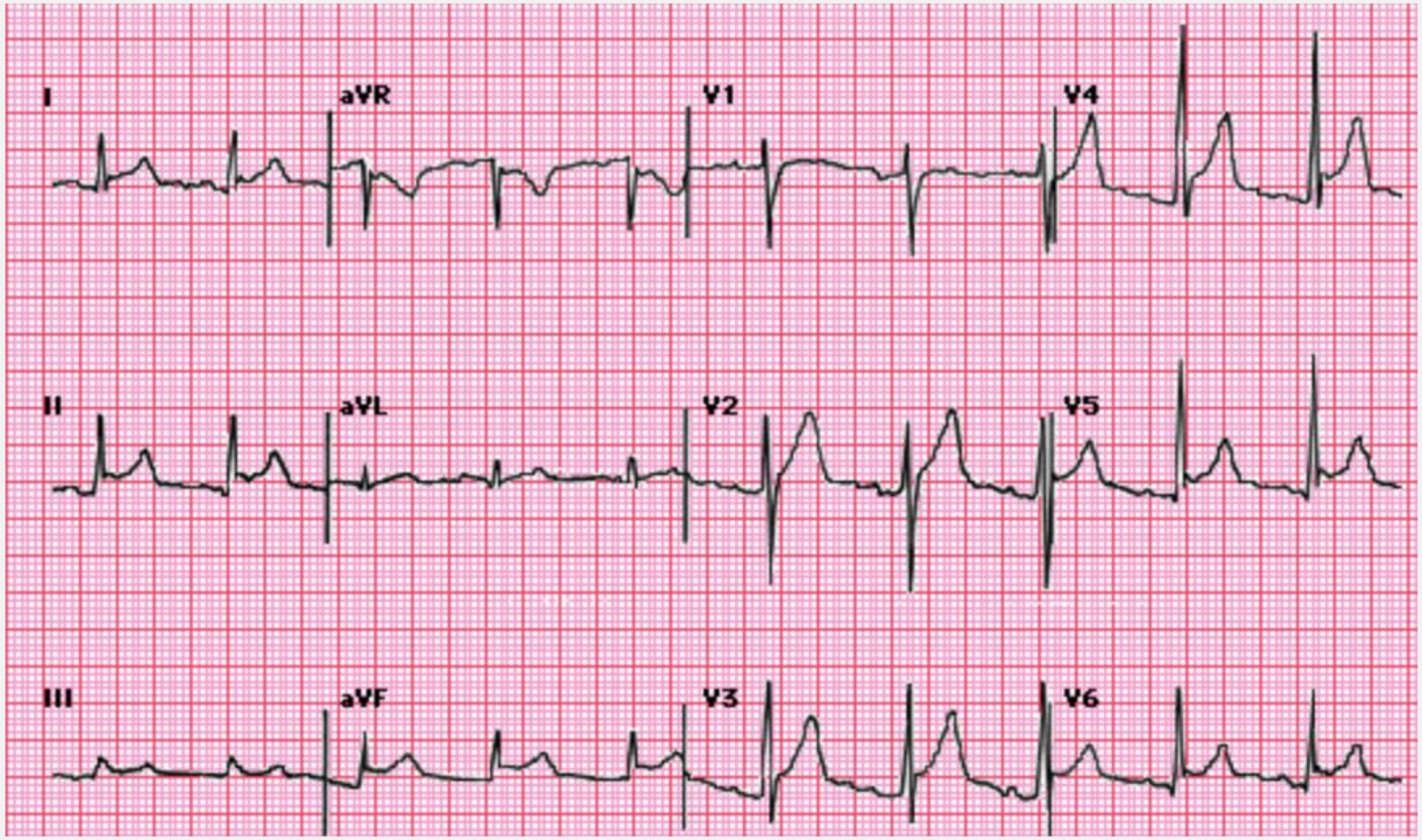


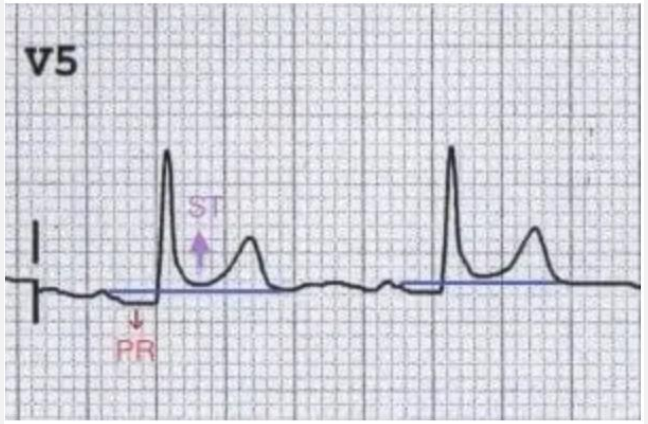
ISCHEMIA RESULTS (THIS IS NOT NEW!)

NONCAD CHEST PAIN

PERICARDITIS

- Inflammation of the pericardial lining
- Etiology: Viral, TB, post cardiac surgery or catheter ablation, autoimmune diseases, malignancy, Dressler Syndrome, Uremia
- Pain characteristics:
  - Sharp/stabbing
  - Positional (sitting up lessens pain)
  - Pleuritic (worsens with inspiration)
- Diagnostic Criteria (2 of 4)
  - Chest pain
  - Pericardial friction rub
  - EKG changes
  - Pericardial Effusion
- Check troponin to evaluate for myocarditis

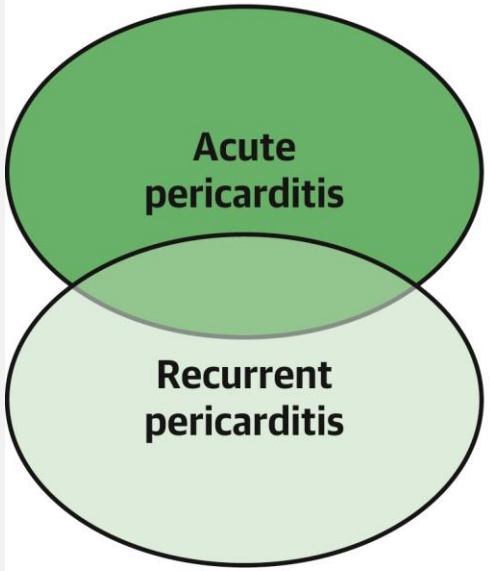




PR depression and ST elevation in V5

Reciprocal PR elevation and ST depression in aVR

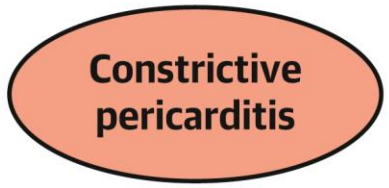
Spodick sign: Downsloping TP segment



DRUG	DOSE	DURATION
Aspirin	750-1,000 mg every 8 h	1-2 weeks
Ibuprofen	600-800 mg every 8 h	1-2 weeks
Colchicine	0.5-1.2 mg in one or divided doses	3 months
Aspirin	750-1,000 mg every 8 h	Weeks-months
Ibuprofen	600-800 mg every 8 h	Weeks-months
Indomethacin	25-50 mg every 8 h	Weeks-months
Colchicine	0.5-1.2 mg in one or divided doses	At least 6 months
Prednisone	0.2-0.5 mg/kg/daily	Months
Anakinra	1-2 mg/kg/daily up to 100 mg/daily	Months
Rilonacept	320 mg once, then 160 mg weekly	Months
Azathioprine	1 mg/kg/daily up to 2-3 mg/kg/daily	Months
Methotrexate	10-15 mg weekly	Months
MMF	2,000 mg daily	Months
IVIGs	400-500 mg/kg/day	5 days

Pericardiocentesis

Pericardial window



Active inflammation
- Yes → Anti-inflammatory therapy as first line, pericardiectomy for refractory cases
- No → Pericardiectomy

PERICARDITIS TREATMENT

- Who to hospitalize?
  - Febrile, immunosuppressed, cardiac tamponade, failure to improve after 7 days of treatment
- If recurrent or refractory symptoms consider:
  - NSAID taper
  - ESR/CRP guided taper
  - Avoid steroids as first line treatment as risk of recurrence is high!

SUMMARY

- Start with a good chest pain history
- Is the pain acute or chronic
  - ACS vs stable angina?
- Know common EKG findings
- Use Clinical Decision Pathways
- Know the benefits and contraindications to different stress test modalities
- Don’t forget about CCTA
- In stable patient’s who needs invasive coronary angiography (cath)
  - ISCHEMIA Trial

QUESTIONS?